89. Experiments with Step Down Converter TPS54332 **V1.1**

UFO-Doctor, Febr. 25th, 2015

1. Introduction

The IR-LED SFH 4233 needs >1.4V@1A (max 1.8@1A), see datasheet.
Three such IR-Diodes in series require a voltage > 5.4V and should be driven by current control.
Our supply is a two cell Lipo 0.9Ah, nominal voltage 7.4V, fully charged 8.4V and 6.4V almost empty.
Thus, it make sense to apply a switched step-down converter, delivering a constant output voltage of about 6 V/1A during all Lipo charging conditions for constant operation.

2. Circuit

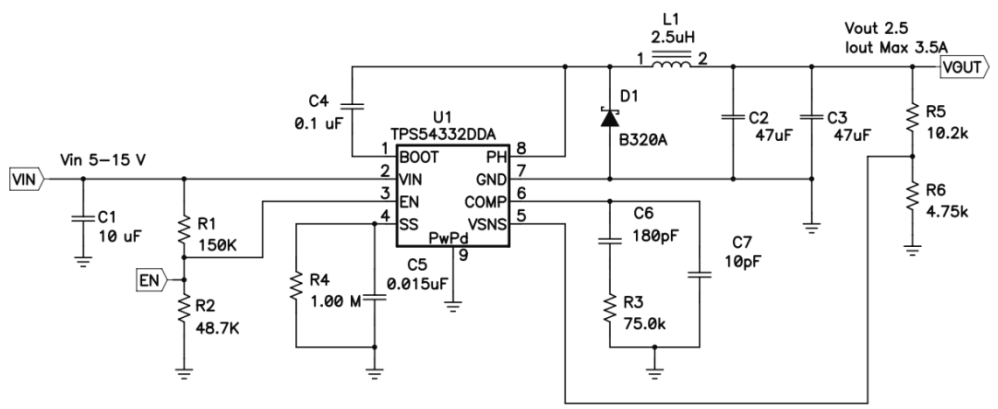

Figure 12. Typical Application Schematic

Fig. 1: Circuit under Test, Vin 7.4V, Vout set to 6V

R1 and R2 not installed, this means EN open= Converter running

3. Problem

The step-down converter TPS54332 (according to the application note) is quite fine, but shows in practice oscillations at little load and low input supply voltage.

ENABLE AND ADJUSTABLE INPUT UNDER-VOLTAGE LOCKOUT (VIN UVLO)

The EN pin has an internal pull-up current source that provides the default condition of the TPS54332 operating when the EN pin floats.

The TPS54332 is disabled when the VIN pin voltage falls below internal VIN UVLO threshold. It is recommended to use an external VIN UVLO to add Hysteresis unless VIN is greater than (V_{OUT} + 2 V). To adjust the VIN UVLO with Hysteresis, use the external circuitry connected to the EN pin as shown in Figure 11. Once the EN pin voltage exceeds 1.25 V, an additional 3 µA of hysteresis is added. Use Equation 1 and Equation 2 to calculate the resistor values needed for the desired VIN UVLO threshold voltages. The V_{START} is the input start threshold voltage, the V_{STOP} is the input stop threshold voltage and the V_{EN} is the enable threshold voltage of 1.25 V. The V_{STOP} should always be greater than 3.5 V.

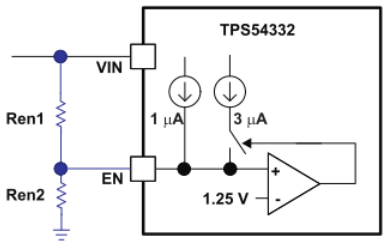

Figure 11. Adjustable Input Undervoltage Lockout

$$Ren1 = \frac{V_{START} - V_{STOP}}{3\ \mu A} \quad (1)$$

$$Ren2 = \frac{V_{EN}}{\frac{V_{START} - V_{EN}}{Ren1} + 1\ \mu A} \quad (2)$$

Fig. 2: Enable and adjustable under voltage Lock out.

Up to now not applied!

4. Experimental results

4.1. Minimum Supply Voltage

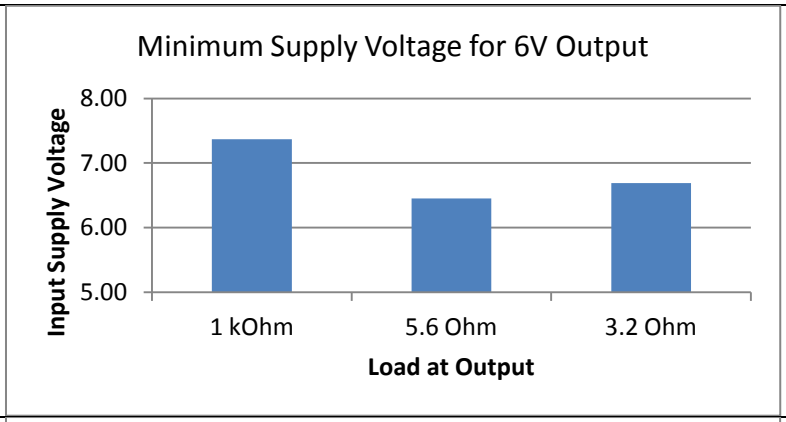

Fig. 3:
Minimum Supply Voltage for 6V output at different loads

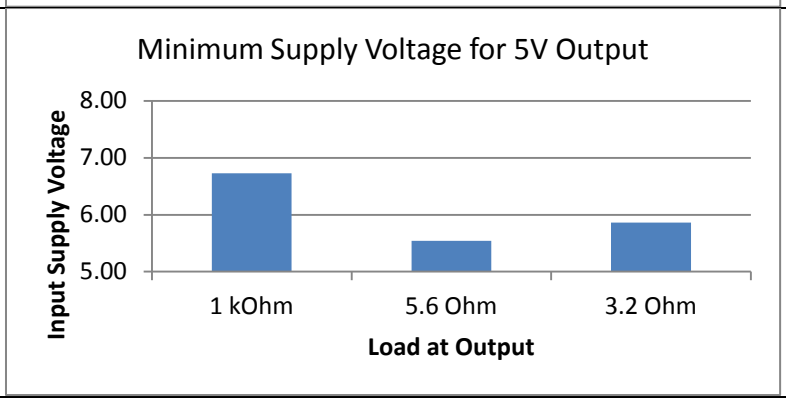

Fig. 4:
Minimum Supply Voltage for 5V output at different loads

Comment:
The output voltage of the step-down converter should be set to maximum 5V for proper operation at variable Lipo supply voltages from 8.4V to 6.4V.

4.2. DC-DC Conversion Efficiency

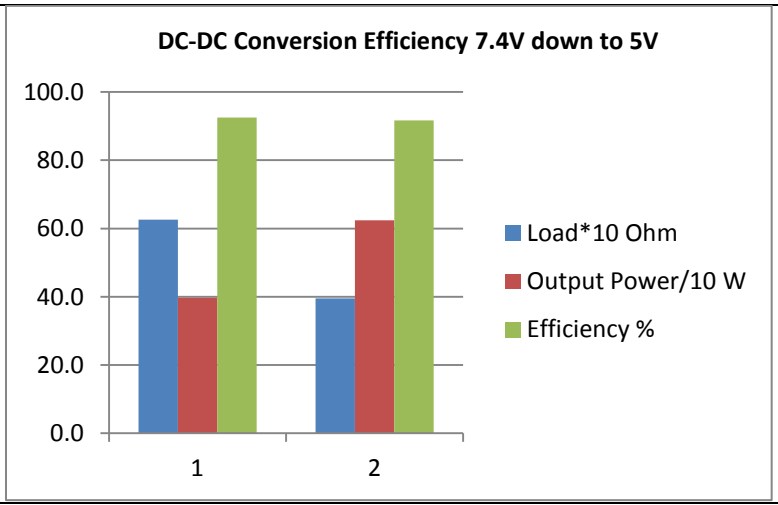

Fig. 5: Conversion Efficiency

Comment:
The DC-DC Step Down Conversion for heavy loads (about 6 and 4 Ohm) is very efficient, more than 90%!

5. Conclusion

It make sense to convert the variable input supply from the Lipo (8.4V to 6.4V) down to 5V for a constant voltage for the high-power IR-LED, consuming 2x1A peak.